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Certificate of grant of a patent

PATENTS ACT, 1992

It is hereby certified that a patent bearing the specification No. 64987 has been granted to SHATTOCK LIMITED, an Irish company, of Derrinlough, Birr, County Offaly, Ireland, in respect of an invention entitled "A screen" which invention was the subject of an application for that patent under Part II of the Act having a date of filing of 21 AUG 1991.

Dated this 5th day of September, 1995.

Controller of Patents, Designs and Trade Marks.

PATENT SPECIFICATION (11) 64987

(21) Application No. 3081/90

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(54) Title "A screen"

(72) Inventor MARTIN MAYE

(73) Patent Granted to SHATTOCK LIMITED, AN IRISH COMPANY, OF DERRINLOUGH, BIRR, COUNTY OFFALY, IRELAND.

The present invention relates to a screen for screening a particular material or other such material having particles, lumps or the like therein, such as, for example, gravel, soil, roots, bark, debris and the like.

Screens for material, in general, are mounted in a screen box. The screen box comprises a pair of spaced apart longitudinally extending side walls joined at their ends by end walls which define, respectively, an upstream end and a downstream end of the screen box. The screen may comprise one or more panels which are mounted in the screen box and form a longitudinal path extending and inclining downwardly from the upstream end to the downstream end for the passage of the material to be screened therealong. As the material passes along the screen from the upstream end to the downstream end smaller particles pass through the screen while larger particles pass along the screen to the downstream end where they are discharged to a slag tip or the like. A vibrator mechanism vibrates the screen box for urging the material to be screened along the material path from the upstream end to the downstream end. The rate at which the material passes along the material path is varied by adjusting the frequency of oscillation or the amplitude of vibrations generated by the vibrating mechanism or by tilting the entire screen box. While varying the

frequency of oscillation of the vibrating mechanism of the screen box does vary the rate at which material passes along the screen, it can also have an adverse effect on the efficiency of screening. Tilting the entire screen box is a cumbersome task. There is therefore a need for a screen, and indeed a screen box which permits variation of the rate of passage of the material along the screen without the need to vary the frequency of oscillation of the vibrating mechanism.

The present invention is directed towards providing such a screen and screen box.

According to the invention there is provided a screen for screening material, the screen having an upstream end and a downstream end and comprising a plurality of screening panels arranged in cascade formation forming a longitudinal material path for the passage of the material from the upstream end to the downstream end, each screening panel extending transversely of the longitudinal material path and having an upstream end and a longitudinally spaced apart downstream end, the downstream end of the screening panels extending over the upstream end of the next adjacent downstream screening panel, at least some of the screening panels being moveable about respective transverse axes extending transversely relative to the longitudinal material path for varying the slope of the said

movable screening panels for in turn varying the flow rate of the material along the longitudinal material path, wherein each movable screening panel comprises a plurality of elongated parallel spaced apart tines extending longitudinally relative to the longitudinal material path, the tines extending from an elongated mounting member which extends transversely of the longitudinal material path, and an elongated transverse carrier member extends transversely relative to the longitudinal material path for mounting the screening panel in the screen, the transverse carrier member defining the transverse axis of the screening panel, and the mounting member being releasably mounted in the carrier member.

Preferably, all the screening panels are movable about respective transverse axes. Advantageously, each movable screening panel is pivotal about a corresponding transverse axis.

In one embodiment of the invention, a securing means is provided for releasably securing each movable screening panel at a desired slope.

Advantageously, the tines of each screening panel extend at their upstream end from the mounting member of the screening panel and are unconnected at their

downstream ends.

In one embodiment of the invention, fastening means are provided for releasably securing the mounting member of each screening panel in its corresponding carrier member. Advantageously, the tines of each screening panel are releasably engagable with the corresponding mounting member. Advantageously, the mounting member is of plastics material.

In one embodiment of the invention, the screen comprises at least one elongated side member extending longitudinally of the material path, each movable screening panel being movably mounted in the side member. Preferably, a pair of spaced apart side members are provided defining the longitudinal material path therebetween, and advantageously, the side members extend parallel relative to each other.

In a further embodiment of the invention, each side member is divided intermediate its ends to form a plurality of transversely abutting side segments to facilitate removal of at least one screening panel relative to the others. Preferably, a pair of side segments are provided for each screening panel.

The invention will be more clearly understood from the following description of some preferred embodiments

thereof, which are given by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a screen box according to the invention comprising a screen also according to the invention,

Fig. 2 is a sectional side elevational view of the screen box of Fig. 1,

Fig. 3 is a perspective view of portion of the screen of Fig. 1,

Fig. 4 is an end elevational view of the portion of the screen of Fig. 3,

Fig. 5 is a side elevational view of a detail of the screen of Fig. 1,

Fig. 6 is a view similar to Fig. 5 showing the detail of the screen in a different position,

Fig 7. is a perspective view of another detail of the screen of Fig. 1,

Fig. 8 is a perspective view of a further detail of the screen of Fig. 1,

Fig. 9 is a perspective view of a screen box according to another embodiment of the invention comprising a screen also according to another embodiment of the invention, and

Fig. 10 is a perspective view of a detail of the screen of Fig. 9.

Referring to the drawings and initially to Fig. 1 to 8 there is illustrated a screen box according to the invention indicated generally by the reference numeral 1 within which is mounted a screen also according to the invention indicated generally by the reference numeral 2 for screening gravel, soil or the like. The screen box 1 comprises a pair of spaced apart parallel side walls 4 of steel joined by end walls 5 and 6 also of steel. The end wall 5 defines an upstream end of the screen box 1 while the end wall 6 defines a downstream end of the screen box 1. A mounting apparatus 8 for mounting the screen box 1 beneath a hopper (not shown) or the like containing material which is to be screened is provided on the screen box 1, see Fig 2. Vibrating apparatus (also not shown) for inducing vibrations into the screen box 1, and in turn the screen 2, for urging the material along the screen 2 from the upstream end to the downstream end is mounted in the screen box 1. Such mounting apparatus and vibrating apparatus will be

well known to those skilled in the art, and it is not intended to describe either apparatus in further detail.

The screen 2 comprises a pair of spaced apart parallel longitudinally extending side members 9 and a plurality of movable screening panels 14 mounted between and extending transversely between the longitudinal side members 9. Each side member 9 is of channel section steel comprising a main web 10 joining top and bottom webs 11 and 12, respectively. The screening panels 14 are arranged in cascade formation and form a longitudinal material path 17 for the passage of the material to be screened from an upstream end 15 to a downstream end 16 of the screen 2, which extends between and parallel to the side members 9.

Each screening panel 14 comprises an elongated transverse carrier member 18 which carries a plurality of parallel equi-spaced apart tines 21 of steel. The tines 21 extend from the carrier member 18 longitudinally relative to the material path 17. Each screening panel 14 extends between an upstream end 22 defined by the carrier member 18 and longitudinally spaced apart downstream end 23 defined by the free ends of the tines 21. Spigots 25 of steel extending from the ends of the carrier members 18 engage the

side members 9. The spigots 25 pivotally engage the side members 9, as will be described below, for movably, in this case, pivotally mounting the screening panels 14 to the side members 9, thereby facilitating varying the slope of the screening panels 14 from the upstream end 22 to the downstream end 23 for varying the flow rate of the material along the material path 17. The tines 21 of each screening panel 14 are unconnected at their downstream end 23 to facilitate the free flow of unscreened material cascading from one screening panel 14 to the next downstream screening panel 14. The downstream end 23 of each screening panel 14 extends over the upstream end 22 of its next adjacent downstream screening panel 14.

Each carrier member 18 is of channel section steel having a pair of side webs 27 joined by a base web 28 which define a recess 30. An elongated mounting member 31 is releasably mounted in the recess 30, and carries the tines 21 of each screening panel 14. The mounting members 31 are of plastics material, in this case polyethylene material, and are of outer dimensions to form an interference fit in the recess 30 so that the mounting members 31 can be slidably removed from the corresponding carrier members 18 in order to facilitate quick and easy replacement of the tines 21 of a screening panel 14. Fastening means for

securing the mounting member 31 of each screening panel 14 in its corresponding carrier member 18 comprises a plurality of screws 33 which engage nuts 34 welded on the carrier member 18. Holes 35 in each carrier member 18 aligned with the nuts 34 accommodate the passage of the screws 33 through the carrier member 18 to engage the mounting member 31 with a grub screw type action. The tines 21 are of solid round stock steel and engage corresponding bores 36 through the mounting member 31 of each screening panel 14 with an interference type fit so that a damaged tine can readily easily be replaced. Reinforcing webs 37 of steel extend partly around the carrier members 18 for stiffening the side webs 27 so that each mounting member 31 is retained in the recess 30 of its corresponding carrier member 18 with the interference fit.

The spigots 25 of each screening panel 14 are welded to the carrier member 18 and define a transverse pivot axis about which the screening panel 14 pivots. The spigots 25 pivotally engage bearings 40 supported in bosses 41 welded to the main webs 10 of the side members 9. Apertures 43 through the main webs 10 of the side members 9 correspond with the bosses 41 for accommodating the spigots 25 therethrough.

Securing means comprising securing bracket members 45

of steel plate material extend from each end of the carrier members 18 and co-operate with the side members 9 for securing the screening panels 14 at a desired slope. Each securing bracket member 45 is welded to its corresponding carrier member 18 and is provided with an adjusting slot 46 which accommodates a releasable retaining means, namely, a screw 47 for retaining the screening bracket member 45 with the screening panel 14 at the desired slope. The screws 47 extend through corresponding slots 46 and engages corresponding threaded holes 48 in the main webs 10 of the side members 9 for securing the bracket members 45 to the side members 9. The slots 46 are of arcuate shape having a centre of radius coinciding with the transverse pivot axis defined by the spigots 25 of the corresponding carrier member 18 to accommodate pivoting of the screening panels 14 between predetermined limits. The predetermined limits are defined by ends 49 of the adjusting slots 46. In this embodiment of the invention, the securing bracket members 45 and the adjusting slots 46 are arranged so that the screening panels 14 are pivotal from a position with the downstream end of one panel resting on the upstream end of the next adjacent downstream panel, see Fig. 5, to a position with the downstream and upstream ends of the adjacent screening panels 14 spaced apart. In this case 28° of pivotal movement of the screening panels 14 is provided.

Angle members 52 extending from and longitudinally along the side walls 4 of the screen box 1 support the side members 9 of the screen 2. Mounting means for mounting and securing the screen 2 in the screening box 1 comprises a plurality of clamping lugs 50 which are welded to and extend from the main webs 10 of the side members 9 adjacent the lower side webs 12 for engaging the angle members 52. Screws 54 through holes 55 and 56 in the lugs 50 and angle members 52, respectively, engage clamping cleats 57 for securing the lugs 50 to the angles members 52, see Fig. 4.

Deflector means for directing material to be screened into the material path 17 comprises a deflector plate 58 secured to and extending upwardly from each side member 9. Each deflector plate 58 comprises an upstanding plate 59 and a plate 60 extending upwardly outwardly of the plate 59 at an angle of approximately 45°. Brackets 61 extending from the deflector plates 58 are secured to the side members 9 by screws 62.

In use, with the screen box 1 mounted at a desired angle beneath a hopper (not shown) containing material to be screened and the vibrating apparatus (not shown) of the screen box 1 operating, the material to be screened is delivered from the hopper (not shown) onto the material path 17 adjacent the upstream end 15 thereof. The vibrating action induced in the

screening panels 14 from the vibrating apparatus urges the material to be screened to cascade from one screening panel 14 to its next adjacent downstream screening panel 14 and so on. As the material cascades along the material path 17 smaller particles of the material pass between the tines 21 for collection and use. Particles of material of size greater than the spacing between the tines 21 cascade along the material path 17 to the downstream end 16 where the material is discharged to a slag tip from the most downstream screening panel 14 under the action of the induced vibration.

Where it is desired to retard the flow of material to be screened along the material path 17 the slope of the screening panels 14 is decreased. In other words the screening panels 14 are pivoted around their respective pivot axes defined by the spigots 25 in the direction of the arrow A (see Figs. 5 and 6) to increase the spacing between the downstream and upstream ends 22 and 23 of respective adjacent screening panels 14. To increase the flow rate of material along the material path 17 the slope of the screening panels 14 is increased. In other words, the screening panels are pivoted in the direction of the arrow B around their respective pivot axes to decrease the spacing between the upstream and downstream ends 22 and 23 of respective adjacent screening panels 14.

Maximum flow rate of the material along the material path 17 is achieved when the downstream ends 23 of the screening panels 14 abut the upstream ends 22 of the next adjacent screening panels 14 as illustrated in Fig. 5. Minimum flow rate is achieved when the spacing between the downstream and upstream ends of adjacent screening panels 14 is maximum as illustrated in Fig. 6. To vary the slope of the screening panels 14 the screws 47 are loosened, thereby facilitating pivoting of the screening panels 14 about the pivot axes defined by the spigots 25. As each screening panel 14 is pivoted to give the desired slope, the screws 47 are tightened thereby securing the securing bracket members 45 to the side members 9.

Should it be desired to replace the tines 21 of a screening panel 14, the screws 33 are unscrewed thereby disengaging the mounting member 31. The mounting member 31 is slid from the recess 30 and a mounting member 31 carrying a fresh set of tines is slid into position in the recess 30 of the carrier member 18. The screws 33 are then tightened in the nuts 34 and engage the mounting member 31 with a grub screw type action. It may be desired to replace the tines 21 of a screening panel 14 in the event of damage or wear to the tines. In other cases, it may be desired to replace the tines 21 of a screening panel 14 with differently spaced tines to vary the

grade of screened material obtained from the screen. In which case, the mounting member 31 of a screening panel 14 or screening panels 14 is replaced with a mounting member carrying tines 21 at the desired spacings.

Should it be desired to replace a single tine 21 in the event of damage or wear to the tine, the mounting member 31 is removed from the carrier member 18 as already described and the worn or damaged tine 21 is removed from the mounting member 31 using a suitable pullers and replaced with a new tine. The damaged or worn tine may also be hammered out of the bore 36 of the mounting member 31 if desired. The mounting member 31 with the new tine 21 is then replaced in the carrier member 18.

Referring now to Figs. 9 and 10 there is illustrated a screen box 70 according to another embodiment of the invention within which is mounted a screen 71 according to another embodiment of the invention. The screen box 70 and the screen 71 are substantially similar to the screen box 1 and screen 2, respectively, and similar components are identified by the same reference numeral. The main difference between the screen box 70 and that described with reference to Figs. 1 to 8 is that the screen 71 comprises a pair of side members 72 which are formed

by a plurality of transversely abutting segments 73. In this embodiment of the invention each screening panel 14 is pivotally connected to a pair of opposite segments 73 of the side members 72. Connecting means for connecting the segments 73 of the side member 72 together is provided by the mounting means namely the clamping lugs 50 which are secured to corresponding angle members 52 on the side walls 4 of the screen box 1. In this embodiment of the invention two clamping lugs 50 extend from the main web 10 of each segment 73 adjacent the lower side web 14.

Deflector means comprising a plurality of deflector plates 75 extend upwardly from the top side webs 11 of the segments 73. The deflector plates 75 extend in a generally downwardly inwardly direction relative to the longitudinal material path 17 for directing material to be screened into the material path 17. Cross members 76 of angle section steel extending between pairs of segments 73 carry flexible flaps 77 which extend downwardly towards the tines 21 of the screening panels 14 for urging smaller particles of the material to be screened between the tines 21.

Operation of the screen box 70 and the screen 71 is similar to the screen box 1 and the screen 2. Material to be screened is delivered onto the screen 71 adjacent the upstream end 15 thereof. Vibrations

induced in the screening panels 14 urge the material to cascade from one screening panel 14 to the next screening panel 14.

In this embodiment of the invention should it be desired to replace a screening panel 14, the screening panel 14 is replaced by removing the segments 73 corresponding to the screening panel 14 and replacing the segments 73 and the screening panel 14 with a fresh set of segments and screening panel. Additionally, the tines 21 or an individual tine 21 of the screening panel 14 may be replaced by removing the mounting member 31 from the carrier member 18 as already described with reference to Figs. 1 to 8.

The advantages of the invention are many. The main advantage of the screen according to the invention is that the flow rate of material along the material path can be varied without the need for altering the amplitude or frequency of the vibrating apparatus. This is achieved by virtue of the fact that the slope of the screening panels may be readily easily varied.

A further advantage of the invention is that by virtue of the fact that the downstream ends of the tines are unconnected a relatively free flow of material to be screened is achieved from one screening panel to the next. Blockages of material between the tines 21 is generally avoided, and where not avoided is minimised by this construction.

Another very important advantage of the invention is achieved by virtue of the fact that the tines are mounted on a mounting member which is in turn releasably mounted in the carrier member. This facilitates ready and easy replacement of the tines of a screening panel. Replacement may be required as a result of damage or wear of the tines of the screening panel or where it is desired to provide a screening panel with tines spaced apart a different distance to provide a different grade of screened material. A further advantage of the invention is achieved by virtue of the fact that the individual tines 21 are releasably secured in the mounting member to facilitate replacement of a single damaged or worn tine.

While the screening panels of the screen have been described as comprising screening panels in which the tines of all the screening panels are spaced apart similar distances, to provide a single grade of

screened material, it is envisaged in certain cases that the spacing of the tines in different screening panels may vary, for example, the upstream panels may be provided with relatively closely spaced tines, while the spacing of the tines in the downstream panels may be greater. In which case screened material of a relatively small particle size would be collected at the upstream end of the screen while screened material of relatively larger particle size would be collected at the downstream end of the screen.

While the screen has been described as comprising screening panels of particular construction, screening panels of other construction may be provided. It is also envisaged that while it is preferable, all the screening panels may not be pivotally mounted to facilitate varying the slope. Needless to say, any other suitable mounting arrangement of the screening panels could be provided for varying the slope of the screening panels besides pivot mounting.

While the screens have been described as comprising deflector means, the deflector means may be dispensed with, and where deflector means are provided other suitable deflector means may be provided.

It is envisaged in certain cases that the side members of the screen may be dispensed with, and in other cases, it is envisaged that a single side member would be sufficient. Needless to say, any other suitable securing means may be provided for securing the screening panels at a desired slope. Furthermore, any other suitable retaining means may be provided for retaining the securing means with the screening panels at the desired slope. It is also envisaged that other suitable fastening means may be provided for securing the tines in the carrier member. Indeed, in certain cases, it is envisaged that the tines may be non-releasably mounted in the mounting member. While a particular construction of carrier member has been described, any other suitable construction of carrier member may be provided. Furthermore, while the screening panels have been described as being pivotal about a transverse pivot axis at the upstream end of each screening panel, the screening panels may be pivotal about an axis which may be disposed at any desired location relative to the screening panels, for example, at the downstream end, or at a position intermediate the upstream and downstream ends. Indeed the transverse pivot axis may lie at the upstream or downstream end of the screening panels spaced apart

from the screening panel.

Needless to say, any other materials besides those described may be used in the construction of the screen and screen box.

Since the slope of the screening panels is independently adjustable, it will be appreciated that in many cases, the screening panels may be set at different slopes relative to each other.

While the screen in the embodiment of the invention described with reference to Figs. 1 to 8 has been described as comprising a single pair of elongated side members, it is envisaged in certain cases that the screen may be provided in sections, each section comprising a pair of side members, and, for example, four screens, as, for example, is illustrated in Fig. 3. The sections would then be mounted in the screen box as already described.

CLAIMS

1. A screen for screening material, the screen having an upstream end and a downstream end and comprising a plurality of screening panels arranged in cascade formation forming a longitudinal material path for the passage of the material from the upstream end to the downstream end, each screening panel extending transversely of the longitudinal material path and having an upstream end and a longitudinally spaced apart downstream end, the downstream end of the screening panels extending over the upstream end of the next adjacent downstream screening panel, at least some of the screening panels being movable about respective transverse axes extending transversely relative to the longitudinal material path for varying the slope of the said movable screening panels for in turn varying the flow rate of the material along the longitudinal material path, wherein each movable screening panel comprises a plurality of elongated parallel spaced apart tines extending longitudinally relative to the longitudinal material path, the tines extending from an elongated mounting member which extends transversely of the longitudinal material path, and an elongated transverse carrier member extends transversely relative to the longitudinal material path for mounting the screening panel in the screen, the transverse carrier member defining the transverse axis of the screening

panel, and the mounting member being releasably mounted in the carrier member.

2. A screen as claimed in Claim 1 in which all the screening panels are movable about respective transverse axes.

3. A screen as claimed in Claim 1 or 2 in which each movable screening panel is pivotal about a corresponding transverse axis.

4. A screen as claimed in any preceding claim in which a securing means is provided for releasably securing each movable screening panel at a desired slope.

5. A screen as claimed in any preceding claim in which the tines of each screening panel extend at their upstream end from the mounting member of the screening panel and are unconnected at their downstream ends.

6. A screen as claimed in any preceding claim in which the tines of each screening panel are releaseably mounted in the mounting member of the screening panel.

7. A screen as claimed in any preceding claim in which a fastening means is provided for releasably

securing the mounting member of each screening panel in its corresponding carrier member.

8. A screen as claimed in any preceding claim in which the mounting member is of plastics material.

9. A screen as claimed in any preceding claim in which each transverse carrier member is of channel shape cross-section defining a recess for receiving a corresponding mounting member.

10. A screen as claimed in any preceding claim in which the screen comprises at least one elongated side member extending longitudinally of the material path, each movable screening panel being movably mounted on the side member.

11. A screen as claimed in Claim 10 in which a pair of spaced apart side members are provided defining the longitudinal material path therebetween.

12. A screen as claimed in Claim 11 in which the side members extend parallel relative to each other.

13. A scr en as claimed in any of Claims 10 to 12 in which the screening panels are pivotally mounted on each side member.

14. A screen as claimed in any of Claims 10 to 13 in which the securing means for each screening panel comprises at least one securing bracket member extending from the carrier member, the securing bracket member being co-operable with a side member.

15. A screen as claimed in Claim 14 in which the securing bracket member extends from each carrier member longitudinally relative to the material path, and a releasable retaining means is provided for securing the securing bracket member in a desired position to the side member.

16. A screen as claimed in Claim 15 in which each retaining means comprises a screw engagable with one of said side and securing bracket members, and an adjusting slot being provided in the other of said members for accommodating adjusting of the slope of the screening panel.

17. A screen as claimed in any of Claims 14 to 16 in which each screening panel comprises a pair of securing bracket members, one at each end of the transverse carrier member.

18. A screen as claimed in any of Claims 10 to 17 in which each side member is divided transversely

intermediate its ends to form a plurality of abutting side segments to facilitate removal of at least one screening panel relative to the others.

19. A screen as claimed in Claim 18 in which a pair of side segments are provided for each screening panel.

20. A screen as claimed in Claim 18 or 19 in which a releasable connecting means is provided for securing adjacent side segments of each side member together.

21. A screen as claimed in any preceding claim in which a deflector means is provided for directing material to be screened into the longitudinal material path.

22. A screen as claimed in Claim 21 in which the deflector means is mounted on each longitudinal side member.

23. A screen as claimed in Claim 21 or 22 in which each deflector means comprises a deflector plate extending upwardly outwardly relative to the longitudinal material path from each side member.

24. A screen as claimed in any preceding claim in which a mounting means is provided for mounting the

screen in a screen box.

25. A screen substantially as described herein with reference to and as illustrated in Figs. 1 to 8 of the accompanying drawings.

26. A screen substantially as described herein with reference to and as illustrated in Figs. 9 and 10 of the accompanying drawings.

27. A screen box comprising the screen of any preceding claim.

28. A screen box substantially as described herein with reference to and as illustrated to the accompanying drawings.

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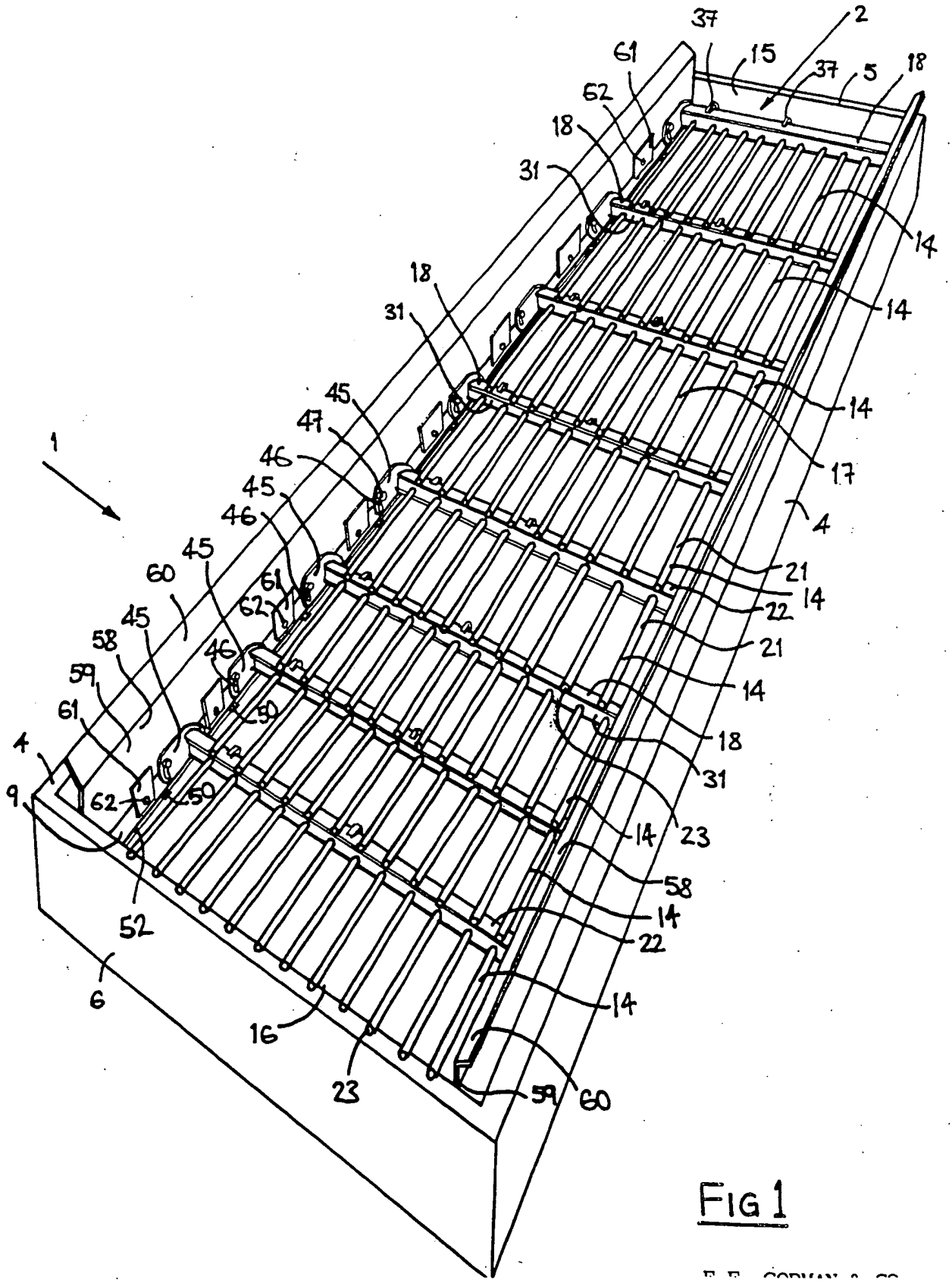

FIG 1

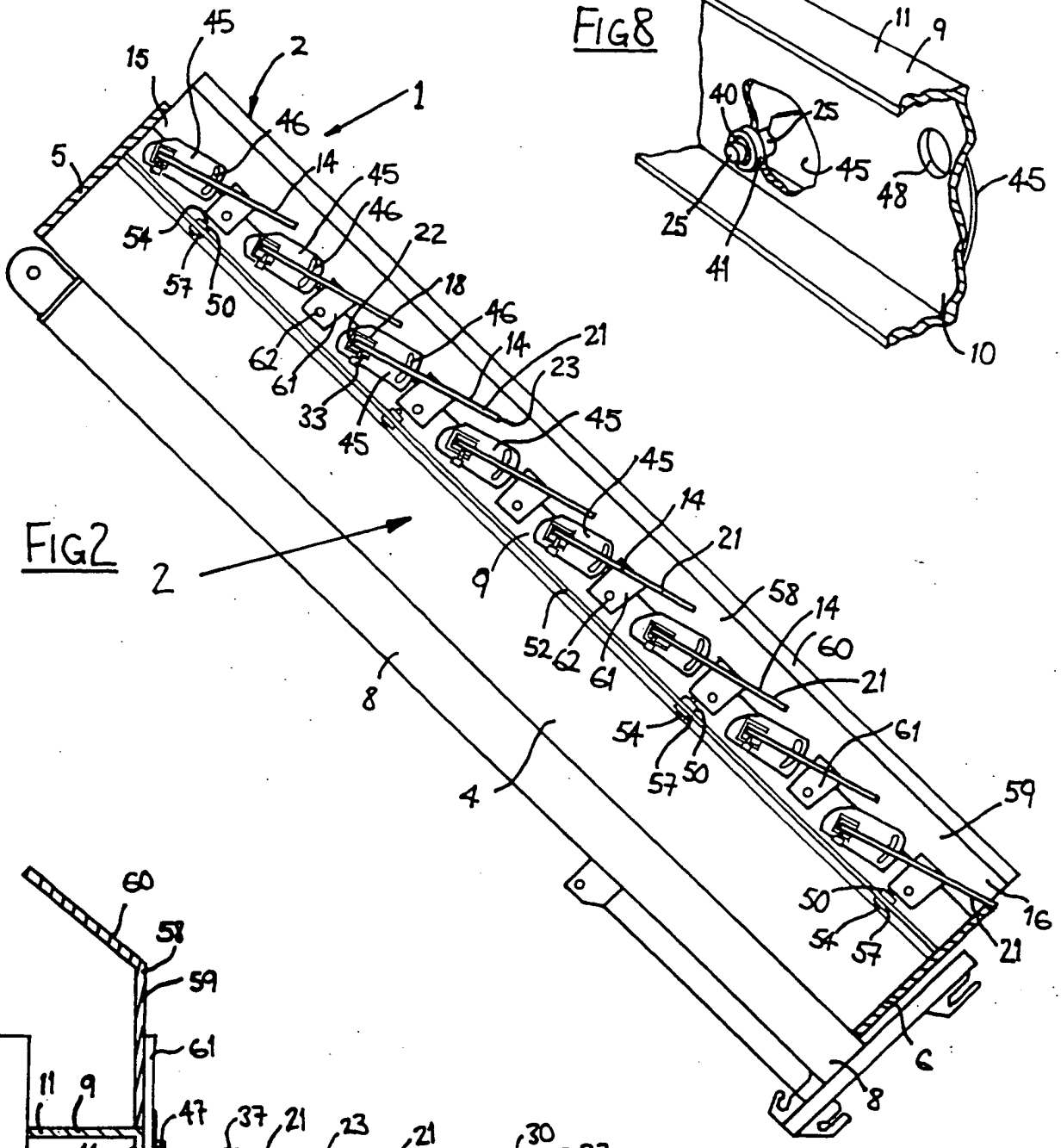
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FIG8
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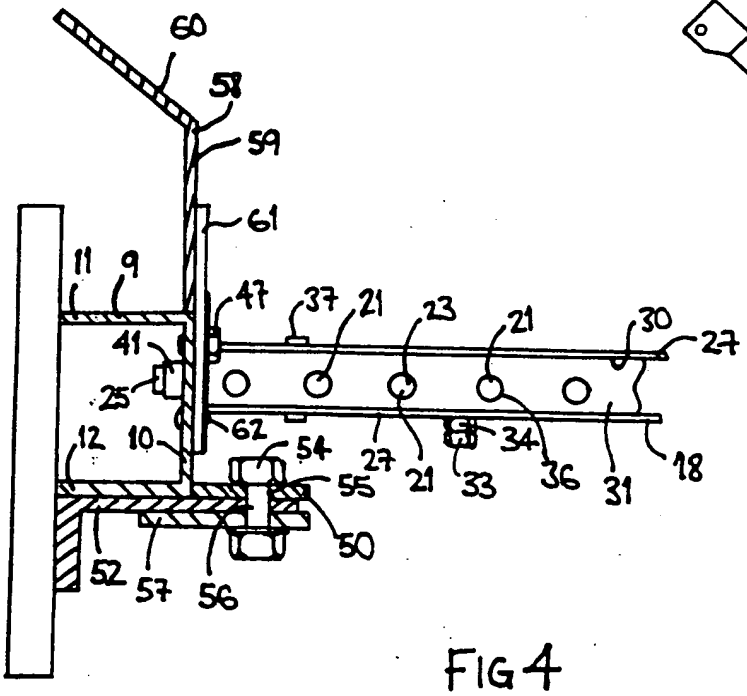
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FIG4

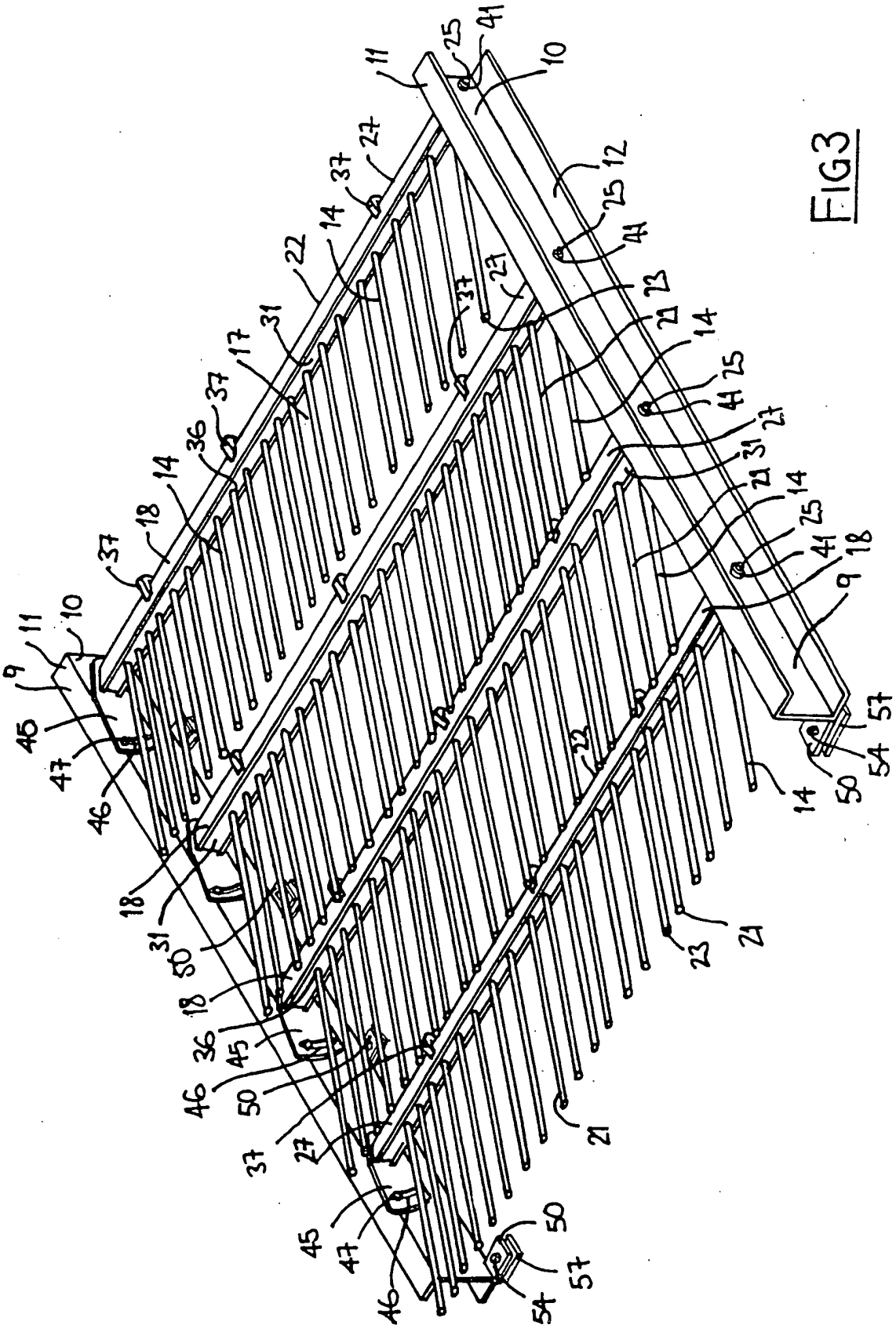


FIG3

FIG 5

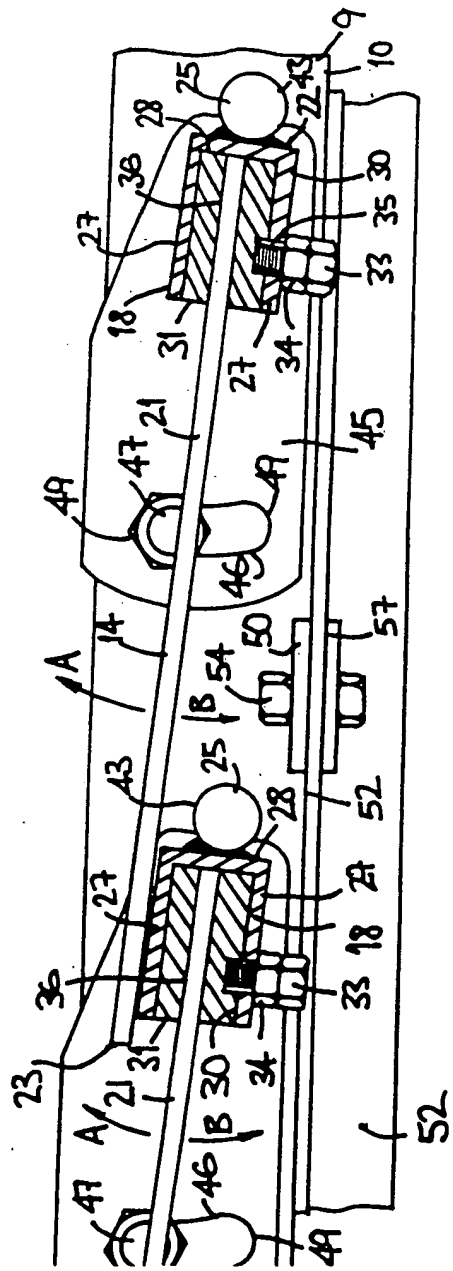
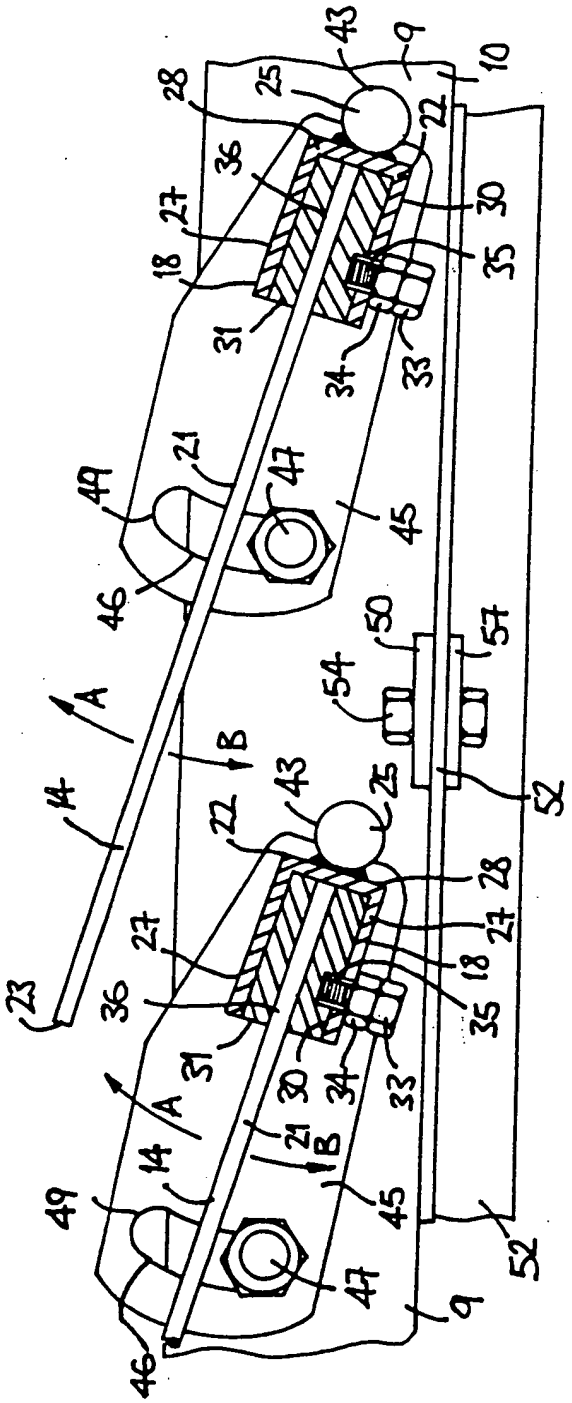


FIG 6



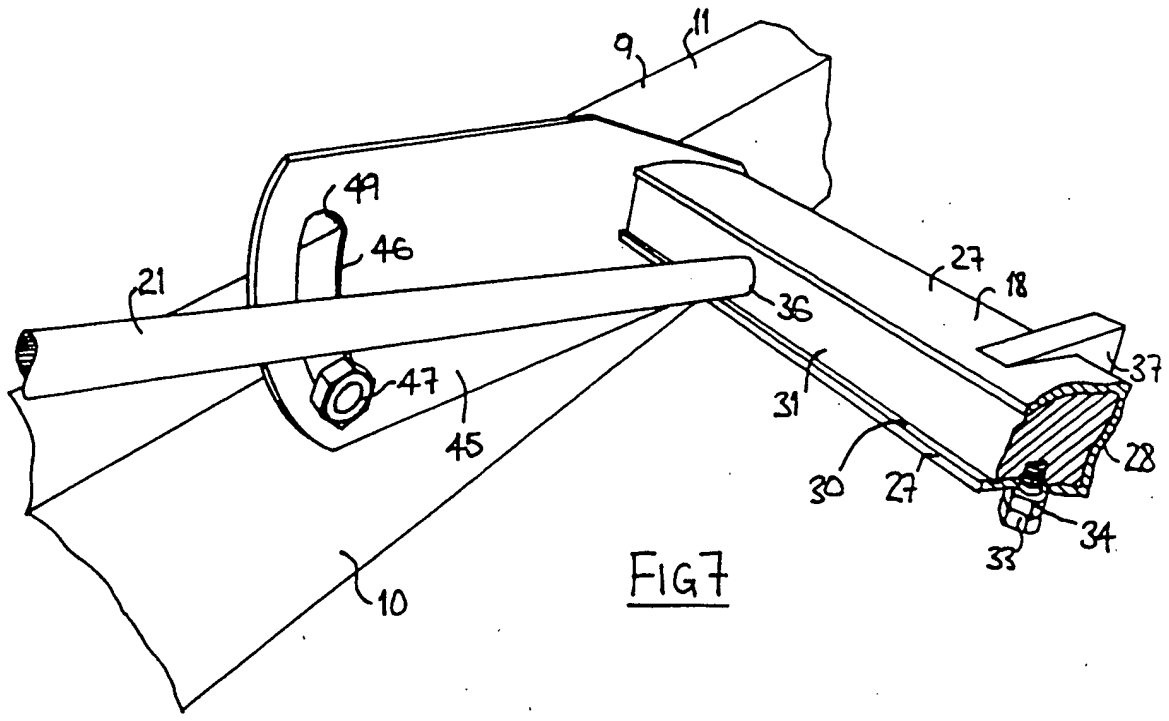

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FIG7

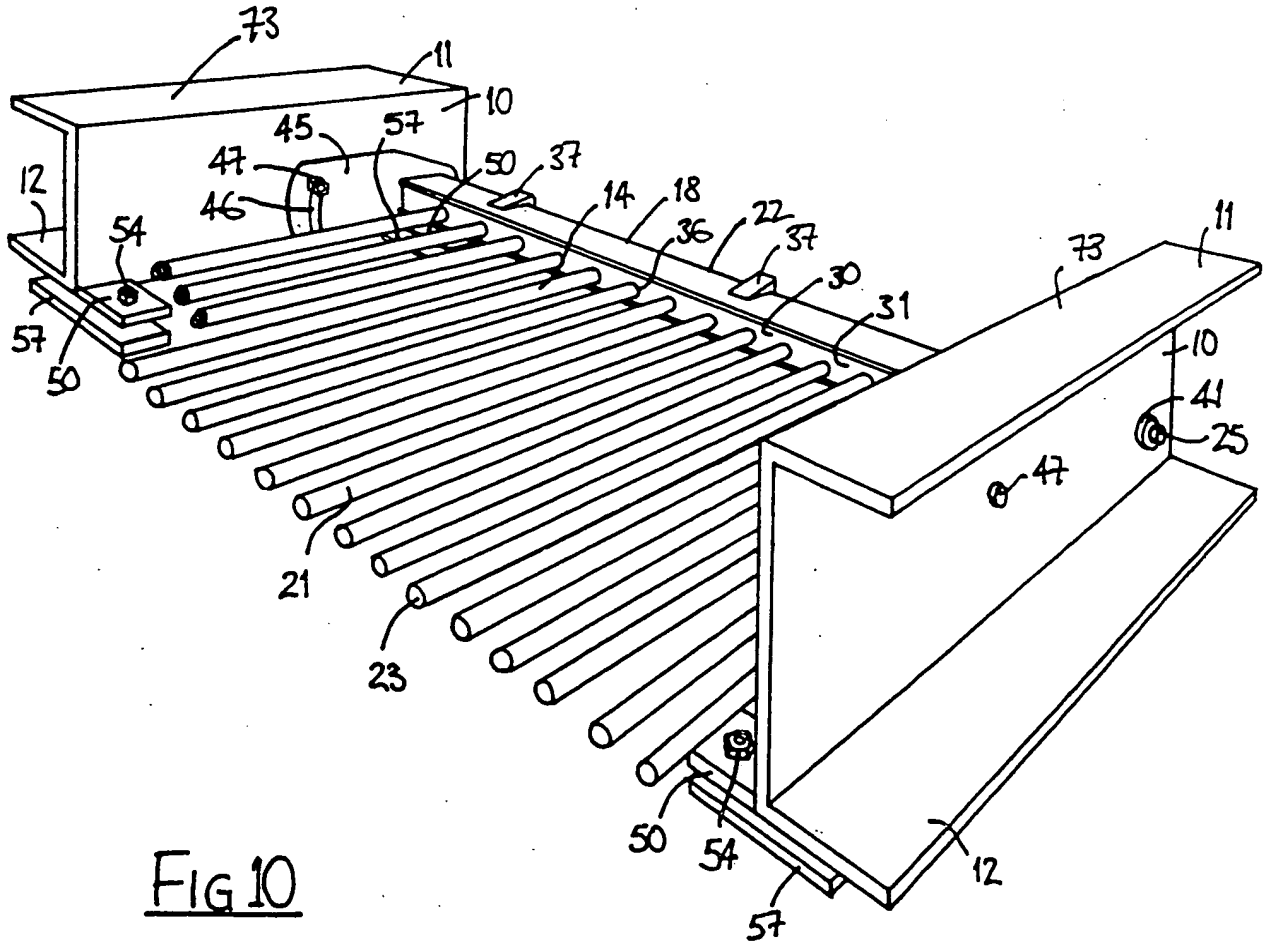
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FIG 10

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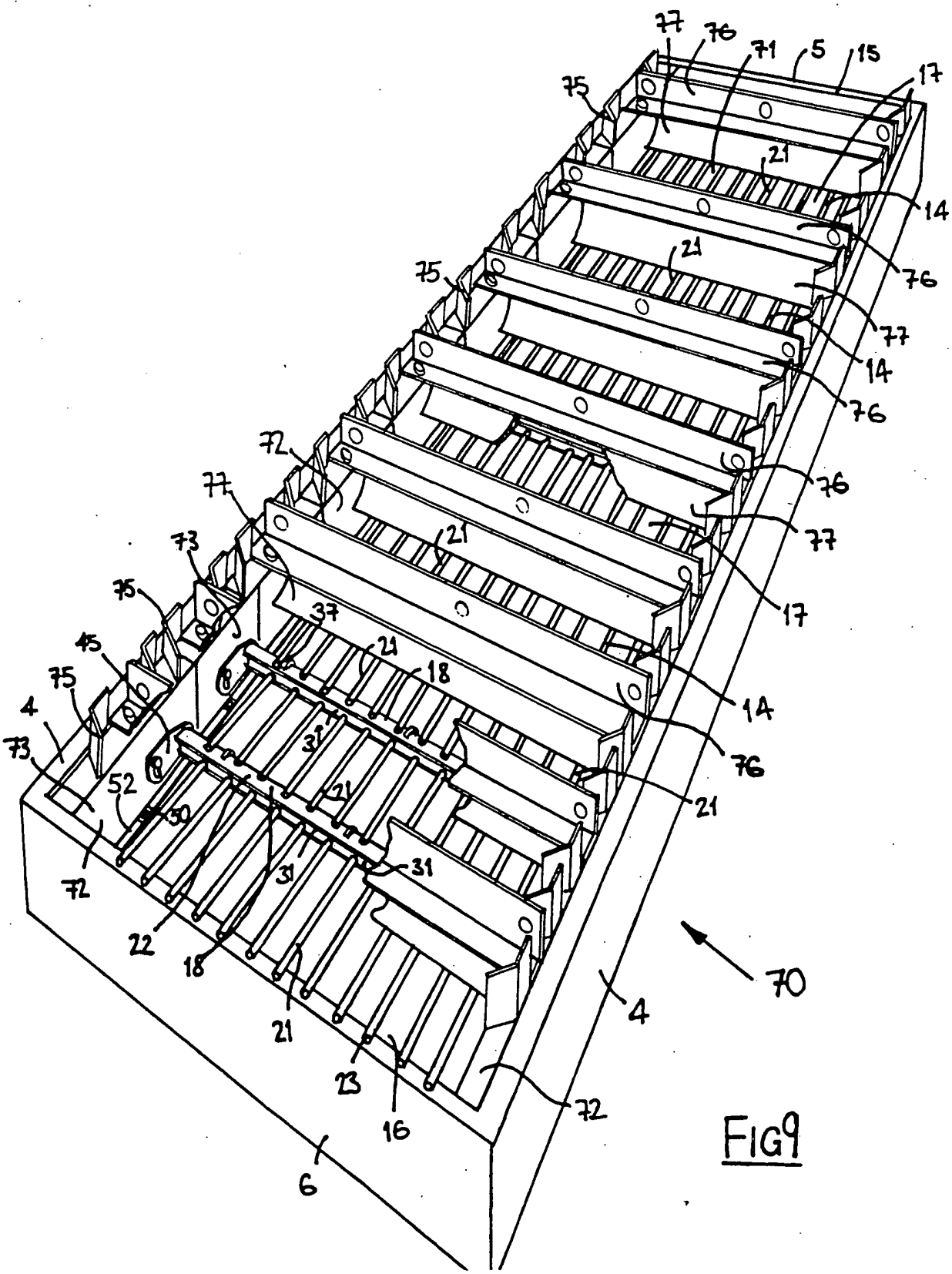

FIG9